

STATUS OF GEOTHERMAL DEVELOPMENT IN HAWAII-1992

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ABSTRACT

Hawaii plans that geothermal will be a significant part of its energy mix to reduce its 90% dependency on imported oil for its electricity. The resource on the Big Island of Hawaii appears promising. However, the geothermal program in Hawaii continues to face stiff opposition from a few people who are determined to stop development at any cost. The efforts of geothermal developers, together with the State and County regulatory framework have inadvertently created situations that have impeded progress. However, after a 20-year effort the first increment of commercial geothermal energy is expected on line in 1992.

BACKGROUND

The dislocations that occurred in the global oil market in the 1970's and in 1990 were particularly critical for Hawaii which is 90% dependent on petroleum for its electricity. Oahu, with 80% of the State's population and electrical demand, relies almost totally on oil-fired electricity. Further, Oahu has no indigenous resources that could make a significant contribution of firm electricity. The islands in Hawaii are not electrically interconnected.¹

Geothermally produced electricity appears to be one component to solving Hawaii's critical energy problem. Toward this goal, the state embarked on supporting the efforts to determine the viability of this resource. Four private shallow geothermal wells were drilled in the Kilauea East Rift Zone (KERZ) in the 1960's. This exploration indicated that deeper wells would be needed to recover a viable resource. The early Hawaii Geothermal Project led to the drilling of the successful HGP-A well in the lower KERZ in 1976. The well was drilled to 1,951 meters with a bottomhole temperature, in a shut-in condition, of 360 degrees celsius. In 1981, with support from the U.S. Department of Energy, the State built a demonstration 3 MW wellhead generator plant at HGP-A which operated until December 1989 when it was permanently closed down.

Commercial deep well exploration began in 1980. One developer suspended operations in 1985 after the unsuccessful drilling of 3 wells plus a sidetrack generally south of HGP-A. Although high temperatures were attained, the degree of permeability was not commercially adequate. In the same 1980 to 1985 period another developer, Puna Geothermal Venture whose operating partner was Thermal Power Company, drilled 3 successful wells slightly north of HGP-A. All 3 wells were producers but eventually 2 were plugged because of casing problems.²

Wyoming-based True/Mid-Pacific Geothermal Venture commenced exploratory drilling in the Kilauea Middle East Rift in late 1989 following an eight year permitting effort including a major land exchange. They are permitted to explore for, and incrementally develop, up to 100 MW.

The potential for large-scale geothermal activity has caused some public concern about environmental effects and impact on land use. Proper management of its limited land and the need to preserve its uniqueness while allowing for reasonable development has been a major issue for the people of Hawaii for many years. In 1983 the Legislature enacted the Geothermal Resource Subzone Assessment and Designation Act which stated that the exploration and development of Hawaii's geothermal resources is of statewide benefit, and that this interest must be balanced with preserving Hawaii's unique social and natural environment. The law mandated the establishment of Geothermal Resource Subzones, only within which geothermal development activities could take place. Because geothermal development was not a permitted activity in any of Hawaii's broad land use districts...Conservation, Agricultural, Rural and Urban...this Act also provided for a geothermal land use permitting process. The Board of Land and Natural Resources assessed the state for geothermal resources on a county-by-county basis. By 1985 three Geothermal Resource Subzones totalling 22,000 acres had been designated in the KERZ and another 4,000 acres in the Haleakala Southwest Rift Zone on Maui.³

The State continued through the 1980's to try to stimulate geothermal development through the following actions:

- o In 1981, the State initiated the Hawaii Deep Water Cable program to determine the feasibility of a 500MW interisland transmission system between the Islands of Hawaii and Oahu which would encounter ocean depths of almost 2000 meters. The State's \$5 million portion of the program involved Hawaii-specific elements including: integration of the cable with the existing electrical grid on Oahu; economic, legal, financial, and institutional analyses; environmental analysis; overland and ocean route analysis including bathymetric surveys; and public information. The Federal Government share of \$23 million was used to design, fabricate and laboratory

test a cable; develop cable vessel and cable laying parameters; and perform at-sea deployment and retrieval tests on a surrogate cable in the most difficult portions of the ocean route. This program was satisfactorily completed in December, 1989.

- o The statutes were changed to allow the waiver of geothermal royalty payments to the State for up to 8 years for any well.
- o In 1987, Governor John Waihee appointed a blue ribbon Governor's Advisory Board to determine what should be done concerning geothermal development and what the State's role should be. In their initial report the Board noted that the development of 500 MW geothermal energy on the Island of Hawaii for transmission to the Island of Oahu is feasible and highly desirable. The report recommended that the geothermal and cable projects should be undertaken as one integrated project and the project should be a private sector undertaking. The Board forwarded two bills to the Legislature via the Governor, one for a Public Authority to facilitate geothermal and cable development, and the other to establish a consolidated geothermal/cable permit application and review process. Although the bill to establish a Public Authority did not survive because some were concerned about the potential for "public power", the consolidated permitting bill was enacted. The consolidated permitting statute is intended to coordinate and streamline the requirements of a diverse array of government laws and regulations that affect geothermal and cable system development. The statute further requires that all State and County agencies, and invited Federal agencies, participate in the consolidated permit review process. All invited Federal agencies have accepted. ⁴
- o Recent Legislative sessions have appropriated over \$10 million for geothermal resource assessment. The State contracted with the University of Hawaii which drilled three small diameter holes under the Scientific Observation Hole (SOH) program.
- o Consultants have been retained to advise the State on further elements of resource assessment and exploration. At the State's request, Congress appropriated \$5 million in FY 1991 for Hawaii's exploration program.
- o The State has contracted for the preparation of a Master Development Plan and a State Environmental Impact Statement.
- o The State participated with the Hawaiian Electric Company in the preparation of a Request for Proposals and subsequent actions to select a consortium to finance, develop, own and operate the large-scale geothermal/cable system. The State retained legal services and a financial consultant to advise on the type and level of State support to the consortium.

In early 1990, Governor Waihee refocused the State of Hawaii's efforts toward encouraging the private development of geothermal to first satisfy the energy needs of the Big Island. To the extent that smaller scale development proves socially, environmentally and economically feasible and the resource proved sufficient, the State might, at some future date, consider large-scale geothermal development for export by a cable system to Oahu and possibly Maui County.

CURRENT STATUS

Mission Energy Company heads an international consortium selected as best qualified by the Hawaiian Electric Company to perform a large-scale geothermal/cable project. For reasons discussed later in this paper, negotiations toward an agreement to undertake the large-scale geothermal/interisland transmission project have been temporarily suspended.

In 1990, True/Mid-Pacific Geothermal Venture completed four legs from the same well bore at a site about 10 kilometers upslope from the Puna Geothermal Venture site along the Kilauea East Rift. Although their data are proprietary, the company has stated that they attained temperatures in excess of 260 degrees Celsius and that there was some steam entry. True/Mid-Pacific agreed to suspend drilling operations until the Puna Geothermal Venture issues were resolved.

The University of Hawaii completed three Scientific Observation Holes in the lower and middle KERZ at a total cost of almost \$6 million. All revealed high temperatures and preliminary tests indicate that at least two have good permeability.

Recent litigation has further stymied development. In 1991, a Federal court directed no further Federal involvement in Hawaii's geothermal program, such as funding or permits, until a Federal (or NEPA) Environmental Impact Statement is completed and accepted. The U.S. Department of Energy has selected Oak Ridge National Laboratory to conduct this EIS using the \$5 million appropriated for FY 1991 by Congress for Hawaii's geothermal exploration program.

Following the Federal Court decision, another lawsuit sought to enjoin the State and County from further participation with the geothermal program until a State EIS was completed. At this writing (May 1992), this litigation is still pending resolution.

Further complicating geothermal's progress was a March 1991 decision by the Hawaii Supreme Court that resulted in stoppage of both Big Island based projects because the State Department of Health did not have ambient air quality standards for hydrogen sulfide in place when they issued Authority To Construct (ATC) permits to the developers. The department is now undergoing rulemaking procedures to establish those standards to allow development activity to resume.

In early 1991, Puna Geothermal Venture, now wholly owned by OESI Power Corporation (formerly Ormat Energy Systems, Inc.) was close to delivering the first increment of an ultimate 25MW capacity to the utility on the Island of Hawaii. On June 12, 1991, while drilling injection well KS-8, a 31-hour blowout, that some estimated had a 15 megawatt potential, occurred when they hit steam at 3,800 feet. That blowout caused evacuation of some nearby residents and was the source of a number of health complaints. Both the County and the State Department of Health immediately suspended drilling operations and the County later expanded the

suspension to include non-drilling activity including work on the gathering systems and power plant. Puna Geothermal Venture, under a Proclamation of a State of Emergency issued by the County Mayor, quenched the KS-8 well and brought it under full control in late September. Concurrently with getting the well under control, the County and State initiated independent investigations of the drilling equipment and procedures as well as the noise and emission abatement and monitoring. A third element of the investigation was a thorough in-house review of the emergency response procedures. The investigative reports including recommendations were received by the government on July 24 and released to the developer and the public the following day. A joint State-County Task Force met at least weekly from mid-August through the end of September to develop a Geothermal Management Plan toward implementing the numerous investigative recommendations. Puna Geothermal Venture's report on the blowout and their comments on the investigative reports were received by the government in early September. Both the government and PGV succeeded in resolving the critical issues but it was not until late February 1992 that full development was allowed to resume.

Although the State of Hawaii is urgently in need of indigenous alternatives to petroleum fuel, which accounts for 90% of its electricity, the conversion has been slow. The alternatives, such as geothermal, are cause for concern with many residents because they are an "unknown". Further, Hawaii's people are understandably protective about their beautiful islands and tend to view new electric power facilities with concern. These attitudes together with events, such as the June 12 blowout, reduce public confidence and cause regulators to proceed prudently with geothermal development.

Recent surveys, however, indicate that seventy percent of Hawaii's people want geothermal energy. We remain optimistic that industry can provide Hawaii with an energy alternative that is economic, environmentally sound and socially acceptable.

REFERENCES

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